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Water Temperatures of the Nation and Mesilinka River Systems, 1997

R. J. Zemlak and A. R. Langston
December 1997

PWFWCP Report No. 127

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

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Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

Citation: R. J. Zemlak and A. R. Langston. December 1997. Water Temperatures of the Nation and Mesilinka River Systems, 1997. Peace/Williston Fish and Wildlife Compensation Program, Report No. 127. 16pp.

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INTRODUCTION

During the 1991 summer field season (June - October), rivers within the Williston Reservoir Watershed were investigated to identify a suitable system for a pilot stream fertilization project. Studies of chemical, physical, and biological characteristics of Williston Watershed rivers (Barrett and Halsey 1985, Bruce and Starr 1985, Langston and Blackman 1993) were reviewed and suitable systems selected for preliminary analysis.

The Mesilinka River was selected as the most suitable system for the pilot project of nutrient enrichment. The Nation River was identified as a system which would also benefit greatly from a fertilization program, but would not meet as many of the pilot project objectives as the Mesilinka River (ie. The Mesilinka River is considered to be more representative of the rivers found in the Williston Watershed). Results and methodologies of the 1991 preliminary studies are reported in "Stream fertilization feasibility study 1991 data report" (Langston, 1992).

In 1992, a multi year pilot project was initiated on the Mesilinka River to assess the success of a fertilization program on a Northern B.C. interior river system. The project is funded by the Peace/Williston Fish and Wildlife Compensation Program. Program design/implementation and the majority of data collection/analysis is performed by the Ministry of Environment, Lands and Parks Fisheries Research Branch.

This data report summarizes the water temperature data collected from the Mesilinka and Nation Rivers during the summer of 1997. This data is one component of the essential information required to facilitate the proper experimental design of the nutrient enrichment program.

Water temperature data reports from 1992 to 1996 have been produced for these river systems as part of the Fertilization project initiated in 1992.

METHODS

Study Area

The Williston watershed is located in north central British Columbia with its southern boundary 40 km north of Prince George, BC. The watershed area is 70,860 km^2. The Mesilinka and Nation Rivers (Fig. 1) are located on the west side of Williston Reservoir, approximately 125 and 30 km Northwest of Mackenzie, BC respectively. A more detailed description of the study area is available in the "Williston Lake Fisheries Compensation Program management plan" (Blackman et al., 1990).

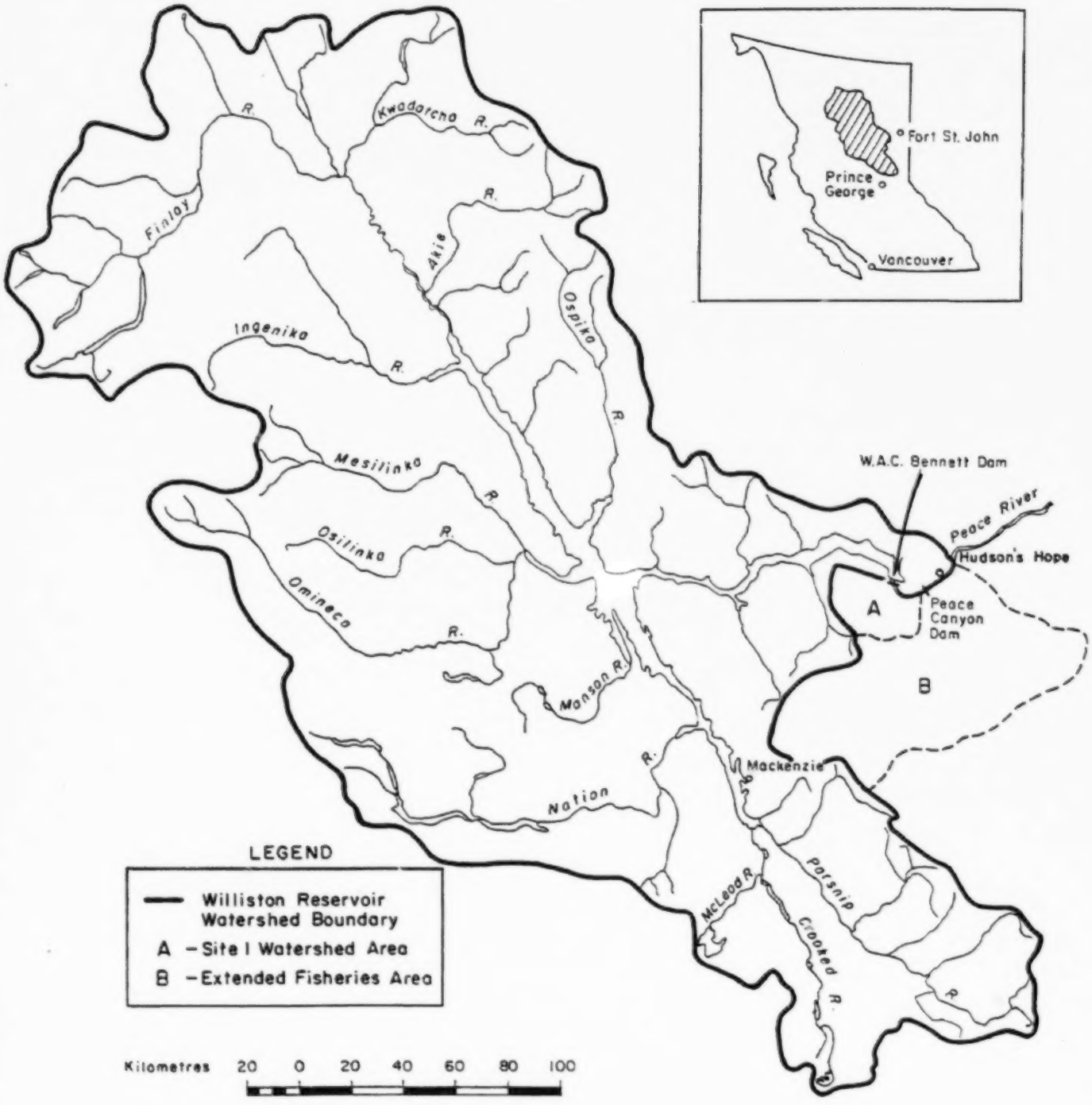


Figure 1. Location of Williston Reservoir

Data Loggers

Water temperatures for the Mesilinka River system were monitored at preselected locations (Fig. 2) with temperature recording data loggers (Onset Instruments Stowaway miniature data loggers). These units are certified to be accurate to ± 0.2° C. Water temperature of the Nation River (Fig. 3) were monitored at one specific site. The Temperature Data loggers were programmed to record water temperatures at two hour sampling intervals for approximately 3 to 4 months. Eight specific sites were selected for monitoring overall. The sites were checked in the field occasionally to ensure the units were completely submerged.

Water temperature data was analysed to determine the mean temperature for each month it recorded and to determine the mean temperature for the sampling period duration for each data logger. Water temperature data was also graphed to provide a visual comparison of water temperatures between each location.

RESULTS

No formal discussion of the results is presented. This data report is intended primarily as an information source only. Data loggers recorded temperatures from the beginning of July until the end of September or October (Table 1). The eight selected sites were: Blackpine, Carina Cr., Gopherhole Cr., Fatfish Cr., Control Cr., Gratton's, Culvert Cr., and the Nation River. The shortest duration (69 days) a data logger recorded water temperatures was at the "Blackpine" location. The longest duration (118 days) a data logger recorded was at the "Nation River" site.

Table 1. Mean water temperatures (° C) by month and sampling period duration.

LOCATION	RECORDING PERIOD	JULY MEAN	AUG, MEAN	SEPT. MEAN	OCT. MEAN	DURATION MEAN
Blackpine	July 3 - September 9	10.8	11.8	10.1	-	11.1
Carina Cr.	July 3 - October 27	14.6	15.0	10.6	3.3	11.1
Control Cr.	July 1 - September 21	7.6	8.8	6.5	-	7.8
Culvert Cr.	July 1 - September 21	8.4	9.5	6.8	-	8.4
Fatfish Cr.	July 3 - October 27	9.6	8.0	7.2	4.1	7.3
Gopherhole Cr.	July 1 - September 26	8.6	9.8	6.9	-	8.5
Gratton's	July 1 - September 28	11.8	12.7	9.1	-	11.2
Nation R.	July 4 - October 29	15.4	16.1	11.2	4.7	11.9

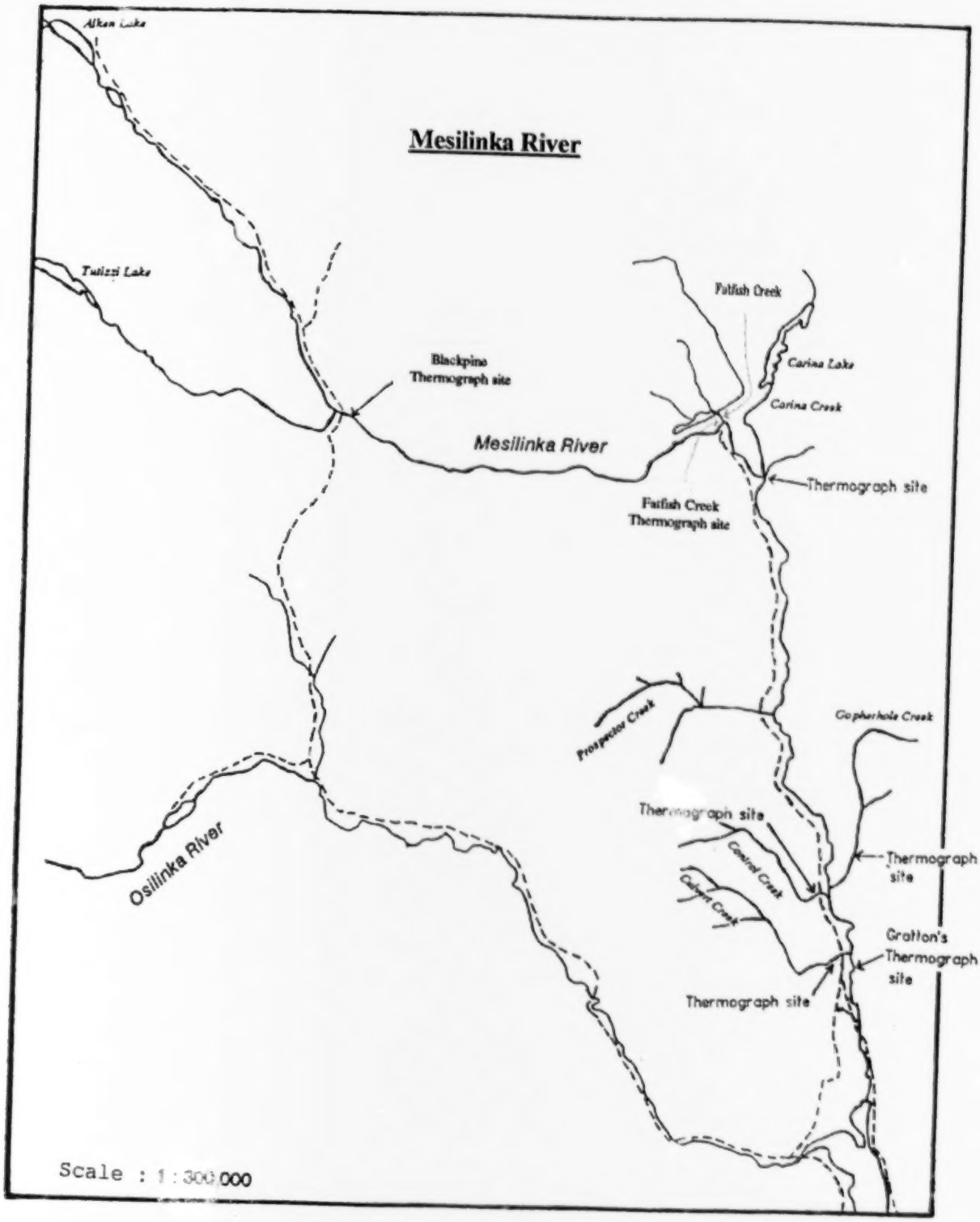


Figure 2. Location of Mesilinka River data loggers.

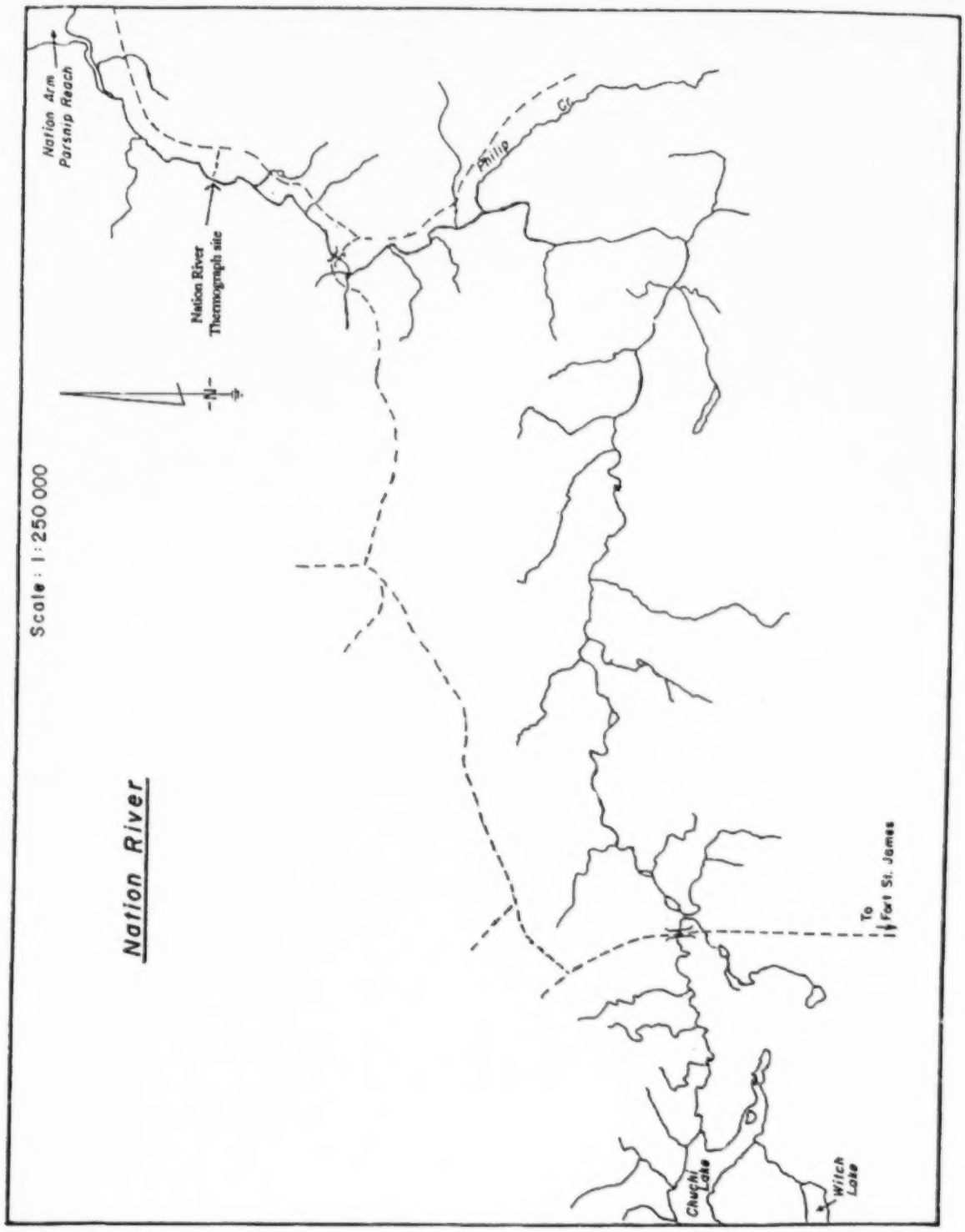


Figure 3. Location of Nation River data logger.

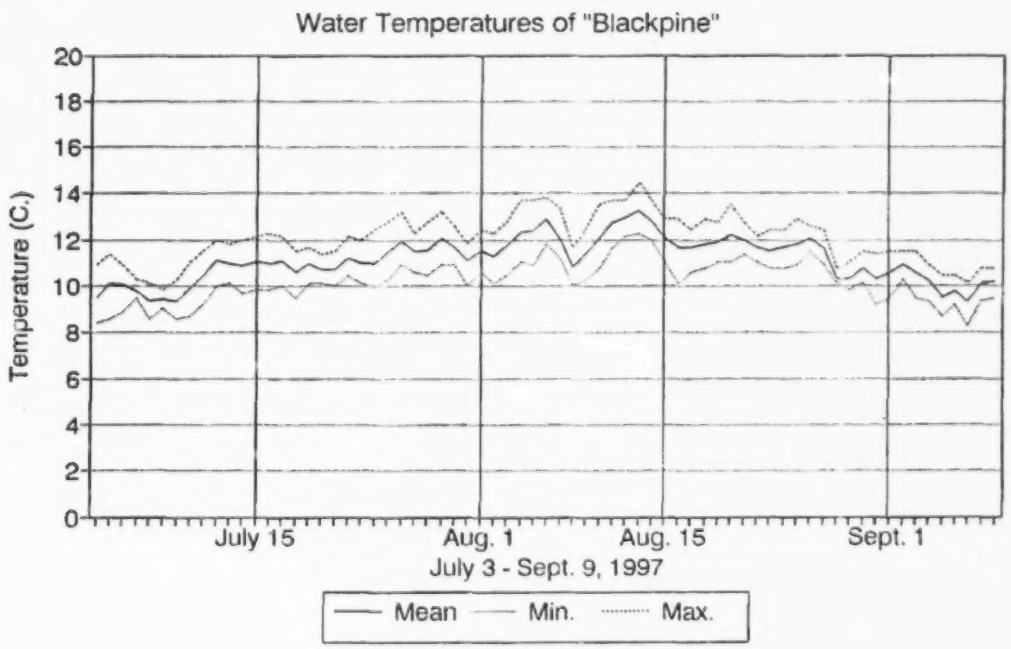
The coldest system sampled for water temperatures was at the "Fatfish Cr." location which had a mean temperature of 7.3 ° C for the duration period. The warmest system sampled for water temperatures was at the "Nation River" location which had a mean temperature of 11.9 ° C for the duration period.

Two data loggers were exposed to air temperatures during the summer of 1997. The Mesilinka River Temperature Datalogger at the "Blackpine" location was exposed to air temperatures from September 10 to 24. On September 24, a Fisheries Technician noticed that this Datalogger had been pulled out of the water and not replaced. By examining the previous water temperature data, it was determined that the data logger was pulled out of the water on September 10. Therefore, the mean water temperatures for the "Blackpine" site were calculated excluding the air temperature data obtained from the September 10 to 24 period. The Mesilinka River Temperature Datalogger at the "Gratton" location was exposed to air temperatures on August 24 to 27 due to receding water levels. The mean water temperatures for this site were calculated excluding the data obtained from August 24 to 27 period.

WATER TEMPERATURES OF MESILINKA RIVER AT "BLACKPINE" LOCATION

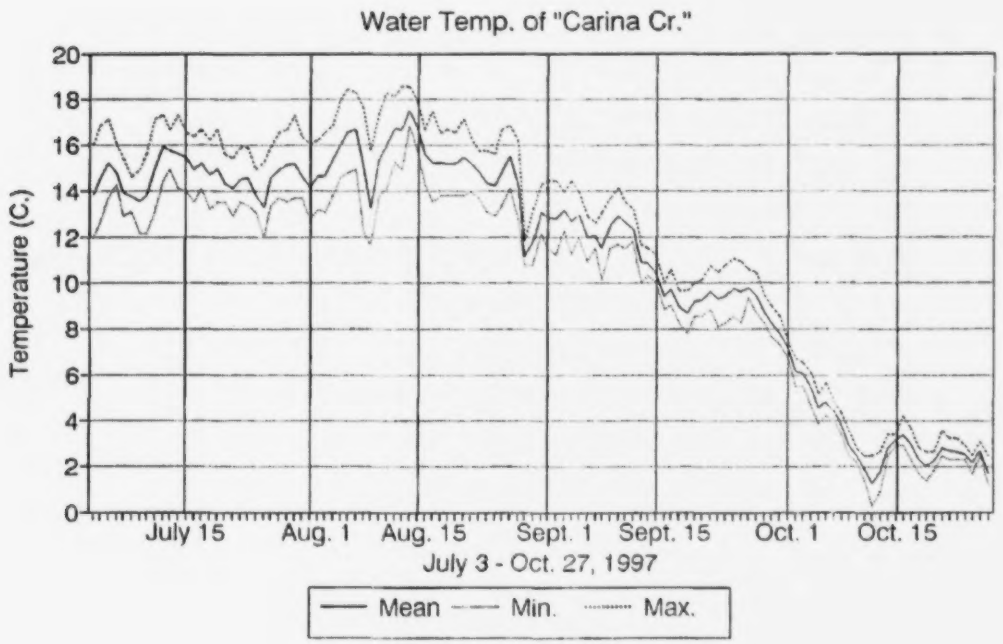
DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
July 1				August 1	11.5	10.6	12.4	September 1	10.6	9.6	11.6	October 1			
July 2	data	logger	installed	August 2	11.3	10.1	12.3	September 2	10.8	10.3	11.5	October 2			
July 3	9.5	8.4	10.9	August 3	11.7	10.5	12.8	September 3	10.5	9.5	11.5	October 3			
July 4	10.1	8.6	11.4	August 4	12.3	11.1	13.7	September 4	10.2	9.3	10.9	October 4			
July 5	10.1	8.9	10.9	August 5	12.4	10.9	13.7	September 5	9.5	8.7	10.5	October 5			
July 6	9.8	9.5	10.3	August 6	12.9	11.8	13.8	September 6	9.7	9.2	10.5	October 6			
July 7	9.4	8.6	10.1	August 7	12.0	11.2	13.4	September 7	9.3	8.3	10.1	October 7			
July 8	9.4	9.0	9.8	August 8	10.8	10.0	11.7	September 8	10.1	9.3	10.8	October 8			
July 9	9.4	8.6	10.3	August 9	11.4	10.3	12.4	September 9	10.2	9.5	10.8	October 9			
July 10	9.9	8.7	11.1	August 10	12.1	10.8	13.6	September 10				October 10			
July 11	10.5	9.2	11.5	August 11	12.8	11.7	13.7	September 11				October 11			
July 12	11.1	10.0	12.0	August 12	13.0	12.1	13.7	September 12				October 12			
July 13	11.0	10.1	11.8	August 13	13.2	12.3	14.5	September 13				October 13			
July 14	10.9	9.7	12.0	August 14	12.9	12.0	13.7	September 14				October 14			
July 15	11.0	9.8	12.1	August 15	12.1	11.1	12.9	September 15				October 15			
July 16	11.0	9.8	12.3	August 16	11.7	10.1	12.9	September 16				October 16			
July 17	11.1	10.0	12.1	August 17	11.7	10.6	12.4	September 17				October 17			
July 18	10.8	9.5	11.6	August 18	11.8	10.8	12.9	September 18				October 18			
July 19	11.0	10.1	11.7	August 19	11.9	11.1	12.8	September 19				October 19			
July 20	10.7	10.1	11.4	August 20	12.2	11.1	13.5	September 20				October 20			
July 21	10.7	10.0	11.6	August 21	12.0	11.4	12.8	September 21				October 21			
July 22	11.2	10.5	12.1	August 22	11.7	11.1	12.1	September 22				October 22			
July 23	11.0	10.1	12.0	August 23	11.5	10.8	12.4	September 23				October 23			
July 24	11.0	10.0	12.4	August 24	11.7	10.8	12.4	September 24	data	logger	pulled	October 24			
July 25	11.5	10.3	12.8	August 25	11.8	10.9	12.9	September 25				October 25			
July 26	12.0	10.9	13.2	August 26	12.1	11.6	12.8	September 26				October 26			
July 27	11.5	10.6	12.3	August 27	11.6	10.9	12.4	September 27				October 27			
July 28	11.6	10.5	12.8	August 28	10.3	10.1	10.8	September 28				October 28			
July 29	12.1	10.9	13.2	August 29	10.3	9.8	11.1	September 29				October 29			
July 30	11.7	10.9	12.6	August 30	10.8	10.1	11.6	September 30				October 30			
July 31	11.1	10.0	11.8	August 31	10.3	9.2	11.4					October 31			

*Shaded entries represent dates thermograph was above water surface and collecting air temperatures.



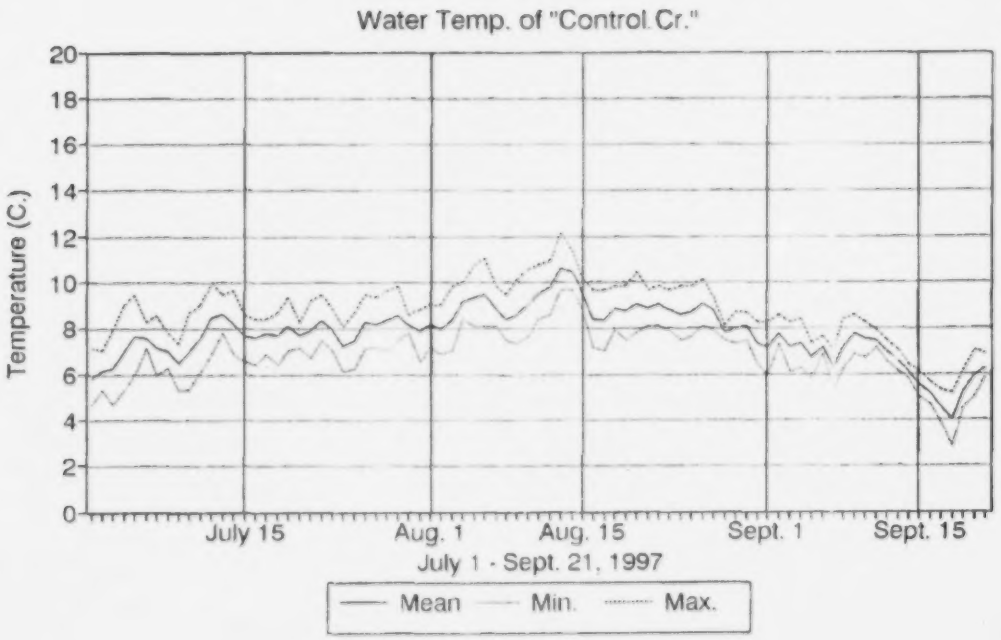
WATER TEMPERATURES OF MESILINKA RIVER AT "CARINA CREEK" LOCATION

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
July 1				August 1	14.7	13.2	16.2	September 1	12.8	11.2	14.6	October 1	7.2	6.7	7.6
July 2	data	logger	installed	August 2	14.7	13.1	16.5	September 2	13.2	12.3	14.0	October 2	6.1	5.5	6.7
July 3	13.8	12.0	16.1	August 3	15.4	13.8	16.8	September 3	12.7	11.2	14.5	October 3	6.1	5.5	6.6
July 4	14.5	12.6	16.8	August 4	16.0	14.6	17.9	September 4	13.0	12.0	14.0	October 4	5.4	4.7	6.1
July 5	15.2	13.7	17.2	August 5	16.6	14.8	18.4	September 5	12.0	10.9	12.9	October 5	4.8	3.9	5.2
July 6	14.8	14.3	16.1	August 6	16.7	14.9	18.3	September 6	12.0	11.5	12.6	October 6	4.8	4.2	5.7
July 7	13.9	12.8	15.4	August 7	15.0	12.1	17.6	September 7	11.5	10.1	13.1	October 7	4.4	4.0	4.8
July 8	13.8	13.1	14.6	August 8	13.2	11.7	15.8	September 8	12.6	11.5	13.7	October 8	3.8	3.4	4.4
July 9	13.8	12.1	14.9	August 9	15.3	13.8	17.3	September 9	12.9	11.7	14.1	October 9	3.0	2.6	3.8
July 10	13.8	12.1	15.8	August 10	16.0	14.1	18.3	September 10	12.8	11.5	13.5	October 10	2.6	2.2	2.8
July 11	16.0	13.1	17.2	August 11	16.8	15.3	18.1	September 11	12.4	11.8	13.2	October 11	1.9	1.4	2.5
July 12	15.9	14.5	17.3	August 12	16.7	14.9	18.6	September 12	10.9	10.0	11.7	October 12	1.3	0.3	2.5
July 13	15.8	14.9	16.7	August 13	17.5	16.8	18.6	September 13	10.8	10.3	11.5	October 13	1.8	0.8	2.8
July 14	15.8	14.1	17.3	August 14	16.8	15.8	17.9	September 14	10.4	10.0	11.2	October 14	2.8	2.5	3.4
July 15	15.4	14.0	16.6	August 15	15.6	14.3	16.7	September 15	9.4	8.9	10.0	October 15	3.2	3.0	3.4
July 16	15.0	13.5	16.4	August 16	15.2	13.5	17.5	September 16	9.7	9.0	10.6	October 16	3.4	3.0	4.2
July 17	15.2	14.1	16.7	August 17	15.2	13.8	16.5	September 17	9.0	8.3	9.7	October 17	3.0	2.3	3.7
July 18	14.7	13.2	16.2	August 18	15.2	13.8	16.7	September 18	8.7	7.8	9.7	October 18	2.3	1.7	2.8
July 19	15.0	13.5	16.7	August 19	15.2	13.8	16.5	September 19	9.2	8.6	10.0	October 19	2.1	1.4	2.6
July 20	14.3	13.5	15.6	August 20	15.6	13.8	17.2	September 20	9.3	8.6	10.1	October 20	2.3	1.9	2.8
July 21	14.1	12.9	15.4	August 21	15.2	14.0	16.4	September 21	9.5	8.9	10.8	October 21	2.8	2.5	3.6
July 22	14.5	13.5	15.9	August 22	14.9	13.7	15.8	September 22	9.3	8.1	10.5	October 22	2.7	2.3	3.3
July 23	14.6	13.4	15.9	August 23	14.3	13.1	15.8	September 23	9.4	8.3	10.8	October 23	2.7	2.3	3.3
July 24	13.8	13.1	14.9	August 24	14.3	12.9	15.6	September 24	9.8	8.6	11.1	October 24	2.5	2.3	3.0
July 25	13.3	12.0	15.3	August 25	14.8	13.4	16.7	September 25	9.6	8.3	10.9	October 25	2.2	1.7	2.5
July 26	14.6	13.4	15.9	August 26	15.5	14.1	16.8	September 26	9.8	9.3	10.6	October 26	2.7	2.5	3.1
July 27	14.9	13.7	16.5	August 27	14.3	12.8	16.2	September 27	9.4	8.7	10.5	October 27	1.7	1.2	2.5
July 28	15.2	13.5	16.7	August 28	11.2	10.8	11.8	September 28	9.7	8.3	9.5	October 28	data	logger	pulled
July 29	15.2	13.7	17.3	August 29	11.7	10.8	13.2	September 29	8.3	7.8	9.0	October 29			
July 30	14.7	13.7	16.4	August 30	13.1	12.1	14.3	September 30	7.8	7.3	8.6	October 30			
July 31	14.2	12.8	16.1	August 31	12.8	11.6	14.5					October 31			



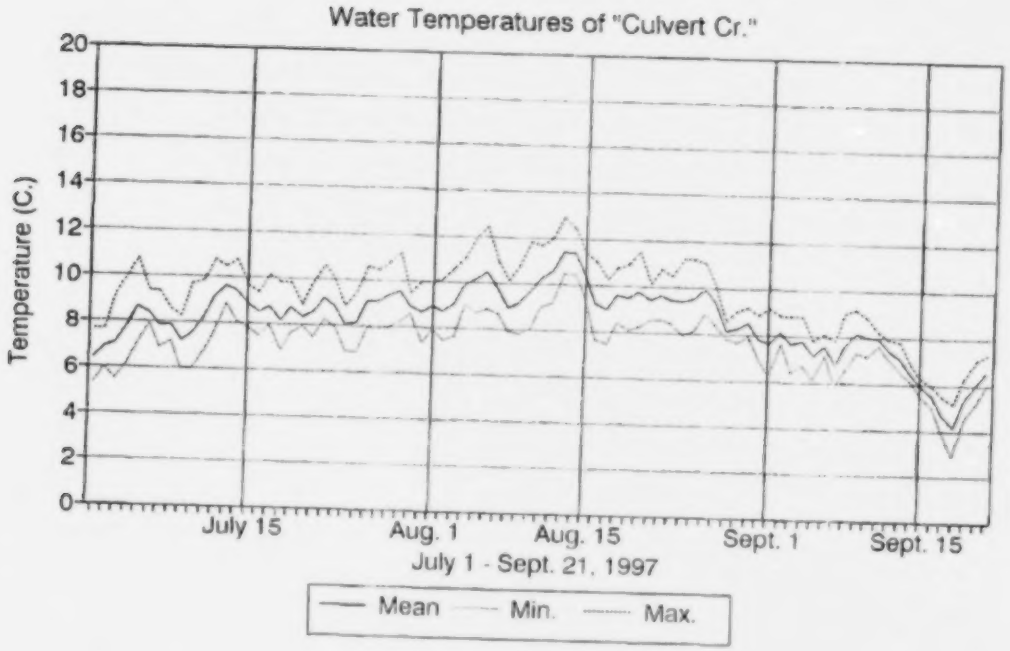
WATER TEMPERATURES OF MESILINKA RIVER AT "CONTROL CREEK" LOCATION

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX
July 1	6.8	4.7	7.2	August 1	8.2	7.2	9.0	September 1	7.2	6.0	8.3	October 1			
July 2	6.2	5.3	7.0	August 2	8.0	6.9	9.0	September 2	7.7	7.3	8.6	October 2			
July 3	6.3	4.7	7.9	August 3	8.3	7.0	9.8	September 3	7.2	6.1	8.3	October 3			
July 4	7.0	5.3	9.0	August 4	9.1	8.4	10.0	September 4	7.3	6.3	8.4	October 4			
July 5	7.8	6.0	9.5	August 5	9.3	8.1	10.8	September 5	6.7	5.8	7.3	October 5			
July 6	7.6	7.2	8.3	August 6	9.5	8.1	11.1	September 6	7.2	6.8	7.6	October 6			
July 7	7.2	6.0	8.6	August 7	8.8	8.1	9.8	September 7	6.3	5.3	7.0	October 7			
July 8	7.0	6.3	7.8	August 8	8.4	7.5	9.5	September 8	7.2	6.3	8.4	October 8			
July 9	6.6	5.3	7.3	August 9	8.6	7.3	10.1	September 9	7.9	6.9	8.8	October 9			
July 10	7.0	6.3	8.7	August 10	9.0	7.6	10.6	September 10	7.5	6.7	8.3	October 10			
July 11	7.8	6.1	9.0	August 11	9.5	8.4	10.8	September 11	7.5	7.2	7.9	October 11			
July 12	8.4	6.9	10.0	August 12	9.8	8.6	10.9	September 12	7.0	6.6	7.5	October 12			
July 13	8.8	7.8	9.5	August 13	10.8	9.7	12.1	September 13	6.8	6.1	7.0	October 13			
July 14	8.2	6.9	9.7	August 14	10.5	9.7	11.4	September 14	6.1	5.8	6.4	October 14			
July 15	7.7	6.6	8.6	August 15	9.6	8.9	10.1	September 15	5.8	5.0	6.1	October 15			
July 16	7.6	6.4	8.4	August 16	8.4	7.2	9.7	September 16	6.2	4.7	6.7	October 16			
July 17	7.8	6.9	8.4	August 17	8.3	7.0	9.7	September 17	4.6	3.9	5.3	October 17			
July 18	7.7	6.4	8.7	August 18	8.8	7.9	9.8	September 18	4.0	2.8	5.2	October 18			
July 19	8.1	7.0	9.3	August 19	8.7	7.5	9.8	September 19	5.2	4.6	6.1	October 19			
July 20	7.7	7.2	8.3	August 20	9.0	7.8	10.5	September 20	5.8	5.0	7.0	October 20			
July 21	7.9	6.7	9.2	August 21	8.8	8.1	9.7	September 21	6.2	5.8	6.9	October 21			
July 22	8.4	7.5	9.5	August 22	9.0	8.1	9.8	September 22	data	logger	pulled	October 22			
July 23	7.9	7.0	8.9	August 23	8.8	7.9	9.7	September 23				October 23			
July 24	7.3	6.1	8.1	August 24	8.6	7.5	9.8	September 24				October 24			
July 25	7.5	6.3	8.7	August 25	8.7	7.6	9.8	September 25				October 25			
July 26	8.3	7.2	9.5	August 26	9.1	8.1	10.1	September 26				October 26			
July 27	8.2	7.2	9.3	August 27	8.8	7.9	9.3	September 27				October 27			
July 28	8.3	7.0	9.7	August 28	7.8	7.5	8.1	September 28				October 28			
July 29	8.5	7.5	9.9	August 29	9.0	7.3	9.7	September 29				October 29			
July 30	8.1	7.8	8.6	August 30	8.1	7.5	8.7	September 30				October 30			
July 31	7.9	6.8	8.9	August 31	7.3	6.4	8.3					October 31			



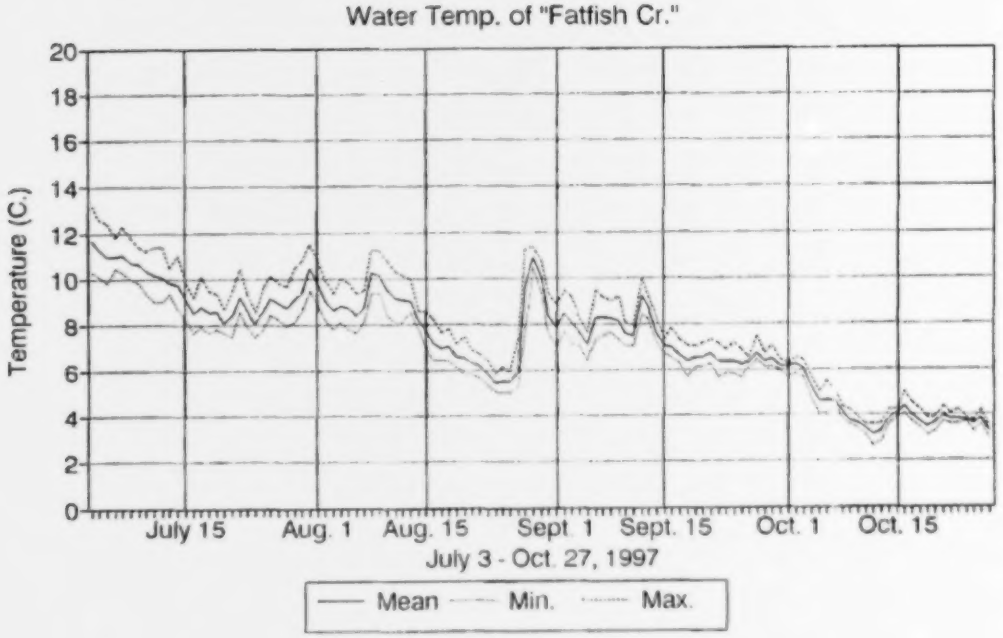
WATER TEMPERATURES OF MESILINKA RIVER AT "CULVERT CREEK" LOCATION

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
July 1	8.4	5.3	7.8	August 1	8.9	7.9	10.0	September 1	7.6	6.3	9.2	October 1			
July 2	8.9	8.0	7.6	August 2	8.8	7.5	10.1	September 2	8.1	7.8	8.9	October 2			
July 3	7.0	5.5	9.2	August 3	9.1	7.5	10.6	September 3	7.7	6.4	8.9	October 3			
July 4	7.8	6.1	10.0	August 4	9.9	9.0	11.1	September 4	7.8	6.7	8.9	October 4			
July 5	8.7	7.0	10.8	August 5	10.1	8.7	12.0	September 5	7.2	6.1	7.9	October 5			
July 6	9.4	7.9	9.3	August 6	10.4	8.9	12.4	September 6	7.6	7.2	8.1	October 6			
July 7	7.9	6.9	9.3	August 7	9.8	8.7	10.9	September 7	6.8	5.8	7.8	October 7			
July 8	7.9	7.2	8.6	August 8	9.0	7.9	10.1	September 8	7.6	6.5	9.0	October 8			
July 9	7.2	6.0	8.3	August 9	9.2	7.8	10.8	September 9	8.2	7.3	9.2	October 9			
July 10	7.5	6.0	9.7	August 10	9.7	8.1	11.8	September 10	8.0	7.2	8.9	October 10			
July 11	8.2	6.7	9.8	August 11	10.3	9.0	11.7	September 11	8.0	7.8	8.3	October 11			
July 12	9.1	7.8	10.9	August 12	10.8	9.2	12.0	September 12	7.4	7.0	7.9	October 12			
July 13	9.8	8.9	10.5	August 13	11.4	10.5	12.9	September 13	7.1	6.8	7.8	October 13			
July 14	9.4	8.1	10.9	August 14	11.4	10.5	12.4	September 14	8.5	8.1	8.9	October 14			
July 15	8.9	7.8	9.7	August 15	10.4	9.5	11.4	September 15	5.9	5.5	6.3	October 15			
July 16	8.5	7.5	9.3	August 16	9.2	7.8	11.1	September 16	5.5	5.0	6.0	October 16			
July 17	8.7	7.9	10.1	August 17	9.0	7.5	10.3	September 17	4.7	3.9	5.5	October 17			
July 18	8.2	6.9	9.8	August 18	9.8	8.4	10.8	September 18	4.2	3.0	5.2	October 18			
July 19	8.7	7.6	9.8	August 19	9.5	8.1	10.9	September 19	5.3	4.5	6.3	October 19			
July 20	8.4	7.9	8.9	August 20	9.8	8.3	11.5	September 20	6.0	5.2	7.0	October 20			
July 21	8.6	7.5	9.8	August 21	9.4	8.6	10.1	September 21	6.6	6.0	7.3	October 21			
July 22	9.2	8.3	10.6	August 22	9.6	8.6	10.8	September 22	data	logger	pulled	October 22			
July 23	8.8	7.8	10.0	August 23	9.5	8.4	10.5	September 23				October 23			
July 24	8.1	6.9	8.9	August 24	9.4	7.9	11.2	September 24				October 24			
July 25	8.1	6.9	9.5	August 25	9.5	8.1	11.2	September 25				October 25			
July 26	9.1	7.9	10.6	August 26	9.9	8.9	11.1	September 26				October 26			
July 27	9.1		10.5	August 27	9.4	8.4	10.1	September 27				October 27			
July 28	9.3	7.9	10.8	August 28	9.2	7.8	9.6	September 28				October 28			
July 29	9.6	8.3	11.2	August 29	8.3	7.6	9.0	September 29				October 29			
July 30	8.9	8.6	9.5	August 30	8.5	7.9	9.2	September 30				October 30			
July 31	8.7	7.3	10.0	August 31	7.8	6.9	8.9					October 31			



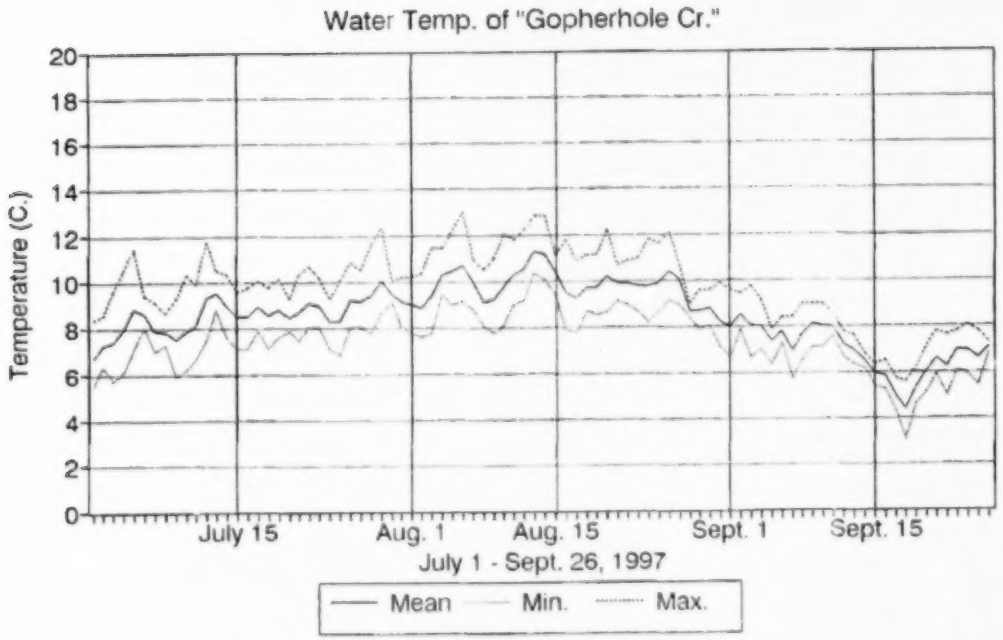
WATER TEMPERATURES OF MESILINKA RIVER AT "FATFISH CREEK" LOCATION

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
July 1				August 1	9.8	8.9	10.8	September 1	7.9	7.0	8.9	October 1	6.1	5.7	6.3
July 2	data	logger	installed	August 2	9.1	8.3	10.0	September 2	8.4	7.6	9.5	October 2	6.2	5.8	6.6
July 3	11.7	10.3	13.2	August 3	8.6	7.8	9.3	September 3	8.1	7.2	9.2	October 3	6.0	5.7	6.4
July 4	11.3	10.1	12.6	August 4	8.8	8.1	10.0	September 4	7.7	7.0	8.3	October 4	5.2	4.7	5.7
July 5	11.0	9.8	12.4	August 5	8.7	7.8	9.8	September 5	7.1	6.4	7.6	October 5	4.6	4.0	5.0
July 6	11.0	10.5	11.8	August 6	8.4	7.6	9.3	September 6	6.3	7.3	9.5	October 6	4.6	4.0	5.5
July 7	11.1	10.3	12.3	August 7	8.8	8.1	9.6	September 7	8.3	7.5	9.2	October 7	4.6	4.4	5.0
July 8	10.7	10.0	11.8	August 8	10.2	9.3	11.2	September 8	8.2	7.6	9.0	October 8	4.1	3.9	4.4
July 9	10.7	9.8	11.4	August 9	10.1	9.3	11.2	September 9	8.2	7.3	9.2	October 9	3.8	3.8	4.2
July 10	10.4	9.3	11.2	August 10	9.5	8.4	10.8	September 10	7.6	7.0	8.1	October 10	3.6	3.4	3.9
July 11	10.2	9.0	11.4	August 11	9.2	8.1	10.3	September 11	7.5	7.0	7.9	October 11	3.4	3.1	3.8
July 12	10.1	9.0	11.4	August 12	9.1	8.1	10.1	September 12	9.2	8.4	10.0	October 12	3.1	2.8	3.8
July 13	9.8	9.3	10.5	August 13	9.0	8.6	10.0	September 13	8.7	8.3	9.2	October 13	3.3	2.9	3.8
July 14	9.7	8.7	11.1	August 14	8.2	7.8	8.6	September 14	7.6	7.2	8.3	October 14	3.9	3.8	4.2
July 15	9.1	8.3	9.8	August 15	7.8	7.0	8.6	September 15	7.0	6.7	7.3	October 15	4.0	3.9	4.2
July 16	8.5	7.8	9.2	August 16	7.2	6.4	8.3	September 16	7.0	6.6	7.8	October 16	4.3	4.0	5.0
July 17	8.8	7.9	10.1	August 17	7.0	6.4	7.6	September 17	6.8	6.3	7.3	October 17	4.0	3.7	4.5
July 18	8.5	7.8	9.5	August 18	7.1	6.4	7.8	September 18	6.4	5.7	7.0	October 18	3.7	3.4	4.2
July 19	8.6	7.8	9.3	August 19	6.6	6.1	7.2	September 19	6.6	6.1	7.0	October 19	3.6	3.1	3.9
July 20	8.1	7.6	8.7	August 20	6.5	5.8	7.5	September 20	6.5	6.1	7.2	October 20	3.6	3.3	3.9
July 21	8.4	7.5	9.5	August 21	6.3	5.8	6.9	September 21	6.7	6.3	7.3	October 21	3.9	3.7	4.4
July 22	9.2	8.6	10.5	August 22	6.2	5.7	6.7	September 22	6.3	5.7	7.2	October 22	3.8	3.6	4.0
July 23	8.6	7.9	9.3	August 23	6.8	5.3	6.4	September 23	6.4	5.8	6.9	October 23	3.8	3.6	4.2
July 24	8.1	7.5	8.6	August 24	6.4	6.0	6.6	September 24	6.4	5.8	7.2	October 24	3.8	3.7	3.9
July 25	8.6	7.8	9.7	August 25	6.6	5.0	6.1	September 25	6.2	5.7	6.9	October 25	3.6	3.3	3.7
July 26	9.1	8.4	10.1	August 26	6.5	6.0	6.0	September 26	6.3	6.1	6.6	October 26	3.9	3.6	4.2
July 27	9.0	8.3	9.8	August 27	6.9	6.3	7.3	September 27	6.7	6.4	7.5	October 27	3.3	3.0	3.4
July 28	8.7	7.9	9.7	August 28	9.6	7.6	11.2	September 28	6.4	6.1	6.7	October 28	data	logger	pulled
July 29	9.1	8.1	10.5	August 29	10.9	10.5	11.4	September 29	6.5	6.1	7.0	October 29			
July 30	9.4	8.6	10.9	August 30	10.1	9.3	10.8	September 30	6.1	6.0	6.4	October 30			
July 31	10.5	9.5	11.5	August 31	8.4	7.6	9.3					October 31			



WATER TEMPERATURES OF MESILINKA RIVER AT "GOPHERHOLE CREEK" LOCATION

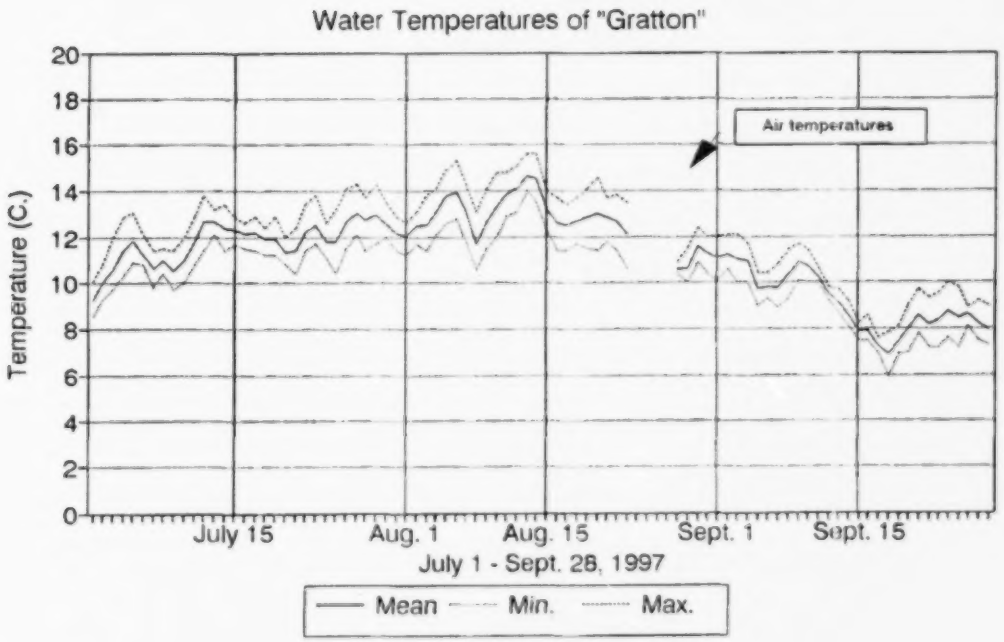
DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
July 1	9.7	5.8	9.4	August 1	9.0	7.8	10.2	September 1	8.0	6.7	9.6	October 1			
July 2	7.3	6.4	9.5	August 2	8.9	7.6	10.4	September 2	9.5	7.9	9.4	October 2			
July 3	7.4	5.7	9.6	August 3	9.4	7.8	11.5	September 3	8.0	6.7	9.8	October 3			
July 4	8.0	6.1	10.5	August 4	10.3	8.4	11.5	September 4	8.0	7.0	9.1	October 4			
July 5	8.9	7.1	11.5	August 5	10.4	9.0	12.2	September 5	7.4	6.4	7.9	October 5			
July 6	8.6	8.1	9.4	August 6	10.7	9.1	13.0	September 6	7.8	7.3	9.4	October 6			
July 7	7.8	7.0	9.1	August 7	10.0	8.8	11.0	September 7	8.9	6.7	8.4	October 7			
July 8	7.8	7.3	8.7	August 8	9.1	8.1	10.5	September 8	7.7	6.5	9.0	October 8			
July 9	7.5	6.9	9.3	August 9	9.2	7.8	11.0	September 9	8.1	7.1	9.0	October 9			
July 10	7.9	6.2	10.4	August 10	9.8	8.1	12.1	September 10	8.0	7.1	9.0	October 10			
July 11	8.1	6.7	9.9	August 11	10.3	9.0	11.8	September 11	8.0	7.8	8.5	October 11			
July 12	9.3	7.4	11.8	August 12	10.6	9.1	12.2	September 12	7.2	6.7	7.8	October 12			
July 13	9.5	8.8	10.6	August 13	11.3	10.4	12.9	September 13	6.9	6.4	7.6	October 13			
July 14	9.0	7.6	10.4	August 14	11.2	10.1	12.9	September 14	6.5	6.2	6.8	October 14			
July 15	8.5	7.1	9.6	August 15	10.4	9.4	11.2	September 15	5.9	5.4	6.4	October 15			
July 16	8.5	7.1	9.8	August 16	9.5	7.9	11.8	September 16	5.8	5.3	6.5	October 16			
July 17	8.9	7.9	10.1	August 17	9.3	7.8	10.9	September 17	5.0	4.3	5.7	October 17			
July 18	8.6	7.1	9.8	August 18	9.7	8.7	11.2	September 18	4.4	3.1	5.8	October 18			
July 19	8.8	7.6	10.2	August 19	9.7	8.6	11.2	September 19	5.3	4.7	6.2	October 19			
July 20	8.6	7.9	9.3	August 20	10.2	8.7	12.2	September 20	6.0	5.1	7.1	October 20			
July 21	8.7	7.4	10.4	August 21	9.9	9.1	10.7	September 21	6.6	5.9	7.8	October 21			
July 22	9.1	8.1	10.7	August 22	9.9	9.0	10.8	September 22	6.2	5.0	7.6	October 22			
July 23	9.0	8.1	10.2	August 23	9.8	8.7	11.0	September 23	7.0	6.1	7.8	October 23			
July 24	8.3	7.1	9.3	August 24	9.7	8.2	11.8	September 24	6.9	5.9	8.1	October 24			
July 25	8.3	6.8	10.1	August 25	9.9	8.7	11.6	September 25	6.6	5.4	7.8	October 25			
July 26	9.2	8.1	10.8	August 26	10.4	9.1	12.1	September 26	7.1	6.8	7.3	October 26			
July 27	9.1	8.1	10.6	August 27	10.0	9.0	10.7	September 27	data	logger	pulled	October 27			
July 28	9.4	7.8	11.6	August 28	8.7	8.4	9.0	September 28				October 28			
July 29	10.0	8.7	12.4	August 29	9.7	7.9	9.6	September 29				October 29			
July 30	9.6	9.1	10.1	August 30	8.8	8.1	9.6	September 30				October 30			
July 31	9.2	8.1	10.2	August 31	8.2	7.1	9.2					October 31			



WATER TEMPERATURES OF MESILINKA RIVER AT "GRATTON" LOCATION

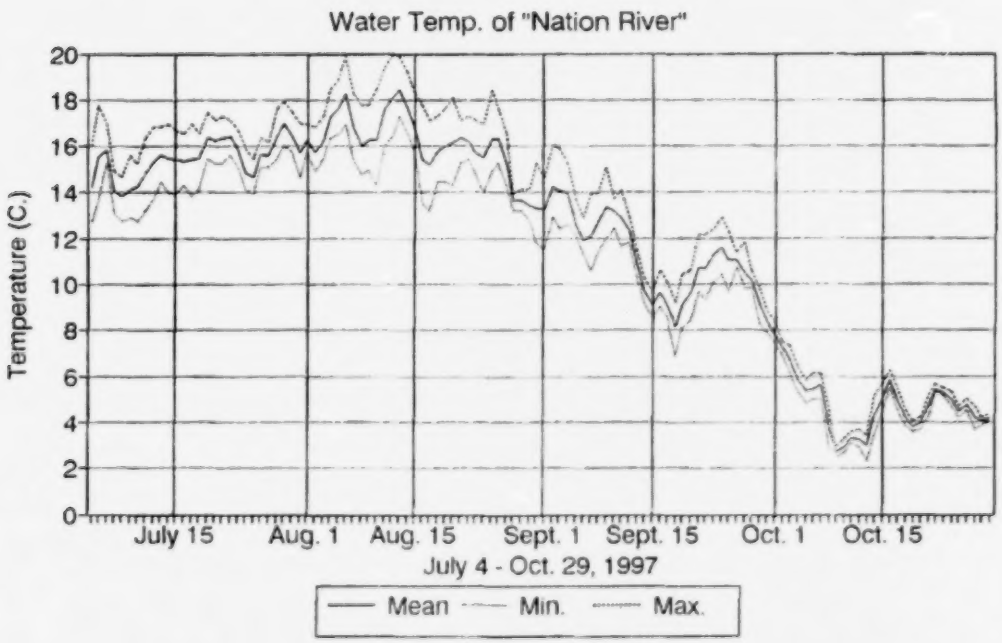
DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
July 1	9.3	8.8	10.1	August 1	12.0	11.2	12.6	September 1	11.1	10.1	12.0	October 1			
July 2	10.0	8.3	10.8	August 2	12.5	11.7	13.1	September 2	11.2	10.6	12.1	October 2			
July 3	10.6	9.7	12.0	August 3	12.5	11.4	13.6	September 3	11.0	10.0	12.1	October 3			
July 4	11.4	10.3	12.9	August 4	13.1	12.1	14.1	September 4	11.0	10.0	11.7	October 4			
July 5	11.9	10.9	13.1	August 5	13.8	12.8	14.9	September 5	9.7	9.0	10.4	October 5			
July 6	11.2	10.8	12.1	August 6	13.9	12.8	15.3	September 6	9.8	9.3	10.4	October 6			
July 7	10.7	9.8	11.4	August 7	13.1	11.8	14.3	September 7	9.8	8.9	10.8	October 7			
July 8	11.0	10.4	11.5	August 8	11.7	10.6	13.1	September 8	10.3	9.3	11.4	October 8			
July 9	10.5	9.7	11.4	August 9	12.6	11.5	14.1	September 9	10.9	10.1	11.7	October 9			
July 10	11.0	10.0	12.0	August 10	13.3	12.0	14.8	September 10	10.7	10.0	11.4	October 10			
July 11	11.8	10.8	12.9	August 11	13.8	12.9	14.8	September 11	10.3	10.0	10.6	October 11			
July 12	12.7	11.4	13.8	August 12	14.1	13.1	15.1	September 12	9.6	9.2	9.8	October 12			
July 13	12.7	12.1	13.2	August 13	14.6	14.0	15.6	September 13	9.1	8.7	9.7	October 13			
July 14	12.4	11.4	13.4	August 14	14.5	13.5	15.6	September 14	8.6	8.1	9.2	October 14			
July 15	12.4	11.7	12.9	August 15	13.2	12.3	14.0	September 15	7.9	7.5	8.2	October 15			
July 16	12.1	11.5	12.6	August 16	12.6	11.4	13.7	September 16	7.9	7.5	8.6	October 16			
July 17	12.2	11.4	12.9	August 17	12.5	11.4	13.4	September 17	7.2	6.9	7.6	October 17			
July 18	11.9	11.2	12.4	August 18	12.7	11.7	13.7	September 18	6.9	6.9	7.8	October 18			
July 19	11.8	11.2	12.8	August 19	12.9	11.5	14.1	September 19	7.4	6.9	8.1	October 19			
July 20	11.3	10.8	12.0	August 20	13.0	11.4	14.6	September 20	8.0	7.0	9.0	October 20			
July 21	11.4	10.4	12.4	August 21	12.8	11.8	13.7	September 21	8.5	7.8	9.7	October 21			
July 22	12.2	11.4	13.4	August 22	12.7	11.4	13.8	September 22	8.2	7.2	9.3	October 22			
July 23	12.5	11.7	13.8	August 23	12.1	10.8	13.5	September 23	8.3	7.2	9.5	October 23			
July 24	11.8	11.1	12.6	August 24				September 24	8.7	7.8	10.0	October 24			
July 25	11.8	10.4	13.2	August 25				September 25	8.5	7.2	9.8	October 25			
July 26	12.7	11.5	14.1	August 26				September 26	8.6	8.1	9.9	October 26			
July 27	13.0	12.1	14.3	August 27				September 27	8.2	7.5	9.2	October 27			
July 28	12.7	11.4	13.7	August 28	10.5	10.4	10.9	September 28	8.0	7.3	9.0	October 28			
July 29	12.9	11.7	14.3	August 29	10.8	10.0	11.5	September 29	data	logger	pulled	October 29			
July 30	12.8	12.0	13.5	August 30	11.6	10.9	12.4	September 30				October 30			
July 31	12.2	11.4	12.9	August 31	11.3	10.4	12.0					October 31			

*Shaded entries represent dates thermograph was above water surface and collecting air temperatures.



WATER TEMPERATURES OF MESILINKA RIVER AT "NATION RIVER" LOCATION

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
July 1				August 1	16.3	15.8	17.0	September 1	13.2	11.5	14.6	October 1	7.9	7.5	8.4
July 2				August 2	15.8	14.9	16.8	September 2	14.2	12.9	16.1	October 2	7.2	6.9	7.5
July 3	data	logger	installed	August 3	16.3	15.4	17.3	September 3	14.1	12.4	15.9	October 3	6.7	6.1	7.3
July 4	14.2	12.8	16.1	August 4	17.2	16.4	18.4	September 4	13.9	12.6	15.3	October 4	5.9	5.3	6.4
July 5	16.5	13.7	17.8	August 5	17.6	16.5	18.9	September 5	12.6	12.1	13.7	October 5	5.4	4.8	5.8
July 6	15.9	15.3	17.0	August 6	18.3	17.0	19.9	September 6	12.0	11.4	12.9	October 6	5.4	5.0	6.1
July 7	14.0	13.1	14.9	August 7	15.8	15.4	18.3	September 7	12.1	10.6	14.0	October 7	5.6	5.0	6.1
July 8	13.8	12.8	14.6	August 8	16.0	14.8	17.8	September 8	12.7	11.4	14.0	October 8	3.8	3.0	4.5
July 9	14.1	12.9	15.6	August 9	16.3	14.9	17.8	September 9	13.4	12.0	16.1	October 9	2.7	2.5	3.0
July 10	14.3	12.8	15.3	August 10	16.3	14.3	18.4	September 10	13.2	12.4	13.7	October 10	2.9	2.6	3.3
July 11	14.8	13.2	16.4	August 11	17.6	16.1	19.4	September 11	12.9	11.7	14.1	October 11	3.3	3.1	3.6
July 12	16.3	13.7	19.0	August 12	18.0	16.4	19.9	September 12	12.4	11.8	12.9	October 12	3.3	3.0	3.7
July 13	15.6	14.5	16.8	August 13	18.4	17.3	19.9	September 13	10.9	10.3	11.5	October 13	3.0	2.3	3.4
July 14	15.5	14.0	17.0	August 14	17.6	16.5	19.2	September 14	9.7	9.2	10.3	October 14	4.3	3.4	5.2
July 15	15.4	14.0	16.7	August 15	16.8	15.8	19.3	September 15	9.1	8.6	9.7	October 15	5.0	4.5	5.7
July 16	15.3	14.3	16.5	August 16	15.4	13.6	17.8	September 16	9.6	9.0	10.6	October 16	5.9	5.5	6.3
July 17	15.4	13.8	17.0	August 17	16.2	13.2	17.2	September 17	9.1	8.6	10.1	October 17	4.9	4.6	5.6
July 18	16.5	14.1	18.5	August 18	15.8	14.5	17.3	September 18	9.1	6.9	9.2	October 18	4.2	3.9	4.5
July 19	16.4	15.4	17.5	August 19	16.0	14.5	17.6	September 19	9.1	8.1	10.5	October 19	3.8	3.6	4.0
July 20	16.3	15.3	17.2	August 20	16.2	14.3	18.1	September 20	9.6	8.4	10.8	October 20	4.0	3.7	4.2
July 21	16.4	15.3	17.3	August 21	16.4	15.3	17.2	September 21	10.7	9.7	12.1	October 21	4.7	4.2	5.2
July 22	16.4	15.6	17.2	August 22	16.2	15.4	17.3	September 22	10.7	9.3	12.1	October 22	5.4	5.3	5.7
July 23	15.8	15.1	16.7	August 23	15.7	14.8	17.2	September 23	11.3	10.1	12.4	October 23	5.3	5.2	5.5
July 24	14.9	14.1	15.8	August 24	15.5	14.0	17.0	September 24	11.5	10.5	12.9	October 24	5.0	4.7	5.3
July 25	14.7	14.0	15.4	August 25	16.3	14.9	18.4	September 25	11.0	9.7	12.3	October 25	4.5	4.2	4.7
July 26	15.7	15.1	16.4	August 26	16.3	15.3	17.6	September 26	11.0	10.8	11.4	October 26	4.7	4.5	5.0
July 27	15.8	15.1	16.2	August 27	15.3	14.3	16.5	September 27	10.5	9.8	11.8	October 27	4.2	3.7	4.7
July 28	16.4	15.4	17.6	August 28	13.7	13.2	14.0	Sepember 28	10.2	9.8	10.6	October 28	4.1	3.9	4.2
July 29	17.0	16.1	17.9	August 29	13.7	13.2	14.1	September 29	9.1	8.3	9.8	October 29	4.2	4.0	4.4
July 30	16.4	15.8	17.5	August 30	13.4	12.8	14.1	September 30	8.4	7.9	8.9	October 30	data	logger	pulled
July 31	15.7	14.8	17.0	August 31	13.3	11.6	16.3					October 31			



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